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KIELIN, ERIK J	
ART UNIT	PAPER NUMBER
2813	8

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/042,342	Applicant(s) ONG ET AL.	
	Examin r Erik Kielin	Art Unit 2813	

-- Th MAILING DATE of this communication app ars on th cov r sh et with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 March 2003* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *6-37* is/are pending in the application.

4a) Of the above claim(s) *35-37* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *6-34* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Election/Restrictions

Newly submitted claims 35-37 directed to an invention that is independent or distinct from the invention originally claimed for the following reasons:

The instant specification has numerous species of polythiophene. New claims 35-37 are directed to new species of polythiophene not already examined.

Since applicant has received an action on the merits for the originally presented invention, this invention has been constructively elected by original presentation for prosecution on the merits. Accordingly, claims 35-37 are withdrawn from consideration as being directed to a non-elected invention. See 37 CFR 1.142(b) and MPEP § 821.03.

Claim Rejections - 35 USC § 112

1. Claims 6-15 and 16-34 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Regarding claims 6 and 16, the specification does not provide support for the newly added limitation that A is a side chain "with at least about 5 atoms." The specification provides support only for "at least about 5 **carbon** atoms." It is further contrary to the teaching in the specification that side chain A be a long side chain but only have 5 atoms. A methoxy group (-OCH_3) has five atoms and does not meet the specification definition of a long side chain.

Claims 7 and 16 was amended to include the limitation, that the side chain B is a short chain alkyl "containing from about 1 to about 4 atoms." This is not possible because the smallest alkyl group is methyl (-CH_3) which clearly contains 4 atoms. There exist no alkyls containing less than 4 atoms. Moreover, the specification refers to B in terms of number of carbon atoms not number of atoms.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims **6**-10, 13, 14, and **16**-19, 22, 25-27 are rejected under 35 U.S.C. 102(b) as being anticipated by US 5,347,144 (**Garnier** et al.).

Regarding independent claim **6**, and claims 7 and 8, **Garnier** discloses a thin film transistor (TFT), comprising a substrate, gate electrode (called "conducting grid"), gate dielectric, and source/drain electrodes (Abstract; col. 2, lines 20-29; col. 6, lines 19-47) and a semiconductor layer comprising a polythiophene derived from monomer segments shown in col. 4, line 35 to col. 5, line 21, labeled as formula "(III)", wherein the source/drain electrodes and gate dielectric layer contact said semiconductor polythiophene. Note that the "conducting grid" necessarily serves as the gate electrode; otherwise the transistor would be inoperable. **Garnier** discloses the polythiophene of formula (III) shown in col. 4, to have the following substituent groups:

X and X' independently represent O, S, Se, Te, or --N(R)--,

R represents H, alkyl, substituted alkyl, aryl, or substituted aryl;

R_1, R_2, R'_1, R'_2, R'_3, and R''_3 each independently represent --H, Cl, F, or a $--CF_3$, $--NO_2$, --CN, $--COOR_3$ group, $--N(R_4)(R_5)$, alkyl, substituted alkyl, aryl, substituted aryl, alkoxy or polyalkoxy,

R_3 represents an alkyl or substituted alkyl group or a metal,

R_4 represents H or an alkyl or substituted alkyl group,

R_5 represents an alkyl, acyl, or aryl group or R_1 and R_2 and/or R'_1 and R'_2 pairs together represent a divalent hydrocarbon group which may be unsaturated or possibly interrupted and/or terminated by at least one heteroatom,

Y, Y_1, Y_2, and Y_3 independently represent the following groups: --C(R')=C(R")-- --C≡C-- --N(R')-- --N=N-- --C(R')=N-- --N=C(R')--, wherein R' and R" independently represent --H, alkyl, substituted alkyl, aryl, or substituted aryl,

a, b, a', b' are numbers equal to 0 or 1, **or Y_1 may also represent a cyclic or heterocyclic arylene group**, and in this case b=1 and a'=0,

s and t are whole numbers, including zero, of which at least one is different from zero,

m' is a whole number equal to at least 1, the numbers s, t, and m' are such that

m' (s+t)=m,

m being a whole number between 4 and 24.

In the oligomer with formula III, units A and A' can alternate regularly or not. In addition, in a given oligomer, the substituents and/or heteroatoms of the units can be different.

In the instant case, units A and A' in **Garnier** are the equivalent of the instantly claimed units (I) and (II) with X being sulfur (chemical symbol S), thereby making A and A' thiophene units.

The sidechains R_1, R_2, R'_1, R'_2, in **Garnier** are equivalent to the instantly claimed sidechains A and B. Since R_1, R_2, R'_1, R'_2, in **Garnier** may be alkyl, they may have more than 5 carbon atoms which anticipates the A sidechain having at least 5 atoms. Since R_1, R_2, R'_1, R'_2, in

Garnier may be alkyl, they may have less than 4 carbon atoms which anticipates the B sidechain having 1 to 4 carbon atoms. Moreover, since R_1, R_2, R'_1, R'_2, in **Garnier** may be H, Cl, or F, this anticipates the B sidechain having 1 atom.

Any of Y to Y_3 in **Garnier** corresponds to D of the instant claims. **Garnier** also discloses that the units A and A' may be zero or any whole number which anticipates the instantly claimed 1-10 of (I) and 0-5 of (II). Note that only one of the subscripted Y's or Y is required since a, a', b, and b' may be zero.

Regarding claims 7-10, although irrelevant since D may be equal to 0, in addition to that indicated above, Y (the instantly claimed D) may be may be cyclic or heterocyclic arylene which anticipates the Markush group of D in the instant claims. And A and B of the instant claims corresponds to the **Garnier** R_1, R'_1, R'_2, and R_2 which may be, *inter alia*, alkyl or hydrogen.

Regarding claims 13 and 14, method limitations do not have patentable weight in device claims. Note that a "product by process" claim is directed to the product per se, no matter how actually made, *In re Hirao*, 190 USPQ 15 at 17 (footnote 3). See also *In re Brown*, 173 USPQ 685; *In re Luck*, 177 USPQ 523; *In re Fessmann*, 180 USPQ 324; *In re Avery*, 186 USPQ 161; *In re Wertheim*, 191 USPQ 90 (209 USPQ 554 does not deal with this issue); *In re Marosi* et al, 218 USPQ 289; and particularly *In re Thorpe*, 227 USPQ 964, all of which make it clear that it is the patentability of the final product per se which must be determined in a "product by process" claim, and not the patentability of the process, and that an old or obvious product produced by a new method is not patentable as a product, whether claimed in "product by process" claims or not. Note that applicant has the burden of proof in such cases, as the above case law makes clear.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 11-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Garnier** in view of US Patent Application 2002/0053320 A1 (**Duthaler** et al.).

Regarding claim 11, **Garnier** discloses gold source/drain electrodes (col. 8, lines 17-18), the gate electrode (called "metal grid") may be a metal such as gold (col. 6, lines 67-68), semiconductor, or conducting organic polymer (col. 6, lines 20-27), the gate dielectric (called "insulating layer") may be, *inter alia*, silicon dioxide (SiO_2) or an insulating polymer, such as polymethylmethacrylate (cols. 7-8, Tables I - III).

Garnier does not specifically indicate the claimed polymers for the gate dielectric (instant claim 12) or the plastic for the substrate (instant claim 15), but as noted above, discloses polymer insulating layers, PMMA being very similar to PMA (polymethacrylate).

Duthaler teaches a TFT and method of forming said TFT having the substrate, gate and source/drain electrode, and gate dielectric materials of instant claims 11, 12, and 15, as well as the methods for depositing these semiconductor device features in instant claims 13 and 14 (albeit not having patentable weight). (See paragraphs [0034] through [0038], [0061], and [0078].)

At the time of the invention, it would have been obvious for one of ordinary skill in the art to use any of the plastics instantly claimed depending upon the desired properties. Selection of a known material based on its suitability for its intended use is *prima facie* obvious. See *In re LESHIN*, 125 USPQ 416 (CCPA 1960) ("Mere selection of known plastics to make container-dispenser of a type made of plastics prior to the invention, the selection of the plastics being on the basis of suitability for the intended use, would be entirely obvious; and in view of 35 U.S.C. 103 it is a wonder that the point is even mentioned.")

It would have been obvious for one of ordinary skill in the art, at the time of the invention to use the materials for each of the semiconductor device features, and the methods of **Duthaler** to make the transistor of **Garnier**, to enable the extremely facile production of TFTs using ink jet printing.

6. Claims **16**-21, and 28-31, 35-37 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Garnier** in view of US 6,320,200 B1 (**Reed** et al.)

Regarding independent claim **16**, 20 and 21, **Garnier** discloses each of the features of the claimed TFT, as noted above, except the third monomeric unit having the B sidechain which is required to be present in claimed formula (III). The monomer D is, as noted above, anticipated by **Garnier**.

Reed teaches polythiophenes for electrical applications as shown the formulas in cols. 29-32 and teaches the instantly claimed central thiophene monomers in the oligomer having an even number (formula 27) or odd number (formula 23) of the B side chain, wherein B is hydrogen. The substitution of the alkyl (the A sidechains) is also shown to match that of the

instant invention, as shown in formula (III) of the instant claims, and is also anticipated by **Garnier**, as noted above since R_1, R_2, R'_1, and R'_2, may be independently varied as at least alkyl and hydrogen, as noted above.

It would have been obvious for one of ordinary skill in the art, at the time of the invention to provide central monomers in the oligothiophene having the hydrogen (B sidechain) in the central portion of the **Garnier** oligomer, in order to provide further control of the conductivity and properties the channel region of the TFT.

Regarding claims 17-19, although irrelevant since D may be equal to 0, in addition to that indicated above, **Garnier** discloses that Y (the instantly claimed D) may be may be cyclic or heterocyclic arylene which anticipates the Markush group of D in the instant claims. And A and B of the instant claims corresponds to the **Garnier** R_1, R'_1, R'_2, and R_2 which may be, *inter alia*, alkyl or hydrogen.

Regarding claim 22, the instantly claimed n corresponds to m' in **Garnier**, which may be 4 to 24, which overlaps 5 to 5,000.

Regarding claims 25-27, the A and D units are as indicated above and are anticipated. Note that D may be zero in accordance with Applicant's claims.

Regarding claims 28-31, the claims are obvious variations of the teaching of **Garnier** in view of **Reed**. Note that the benzyl linkage (monomer D) is anticipated by **Garnier** who teaches that the Y (equal to Applicant's instantly claimed D) is arylene, of which benzene is the most basic and commonly known unit.

7. Claims 23 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Garnier** in view of **Reed** as applied to claims 16 and 17 above, and further in view of US 5,069,823 (**Sato** et al.).

The prior art of **Garnier** in view of **Reed**, as explained above, discloses each of the claimed features except for the number and weight average molecular weight ranges of the polythiophene.

Sato teaches the production of electrically conductive polythiophenes such as those disclosed by the general formula (III) in **Garnier**, wherein the weight average molecular weight is between 60,000 and 100,000 which overlaps the instantly claimed ranges (See Abstract; col. 1, lines 19-33.) Because of the relationship between the number and weight average molecular weights, it is held, absent evidence to the contrary, that the number average molecular weight inherently overlaps those instantly claimed in claims 23 and 24 because of the **Sato** weight average molecular weights. (See MPEP 2112.)

It would have been obvious for one of ordinary skill in the art, at the time of the invention to use the molecular weight for the polythiophene of **Garnier** in view of **Reed** as that taught in **Sato** as a matter of routine optimization. (See MPEP 2144.05.)

8. Claim 34 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Garnier** in view of Reed as applied to claim 16 above, and further in view of US 6,232,157 B1 (**Dodabalapur** et al.).

Garnier discloses that the thickness of the gate dielectric (called "insulating layer") is 0.5 to 10 μm and the thickness of the polythiophene (semiconductor) may be 20 to 200 nm (col. 6,

lines 48-54) which overlaps that instantly claimed. **Garnier** also teaches the thickness for the source/drain electrodes of 25 nm (col. 7, lines 27-30) which is near than instantly claimed.

Garnier in view of **Reed** does not teach the thickness of the substrate to be 10 μm to 10 millimeters.

Dodabalapur teaches a TFT and method for forming having polythiophene as the semiconductor channel wherein the substrate is made from plastic and is 30 to 100 μm, which overlaps that instantly claimed (col. 7, lines 9-11).

It would have been obvious for one of ordinary skill in the art, at the time of the invention to use the substrate thickness of **Dodabalapur** as the substrate thickness in **Garnier** in view of **Reed**, because **Garnier** is silent to the thickness of the plastic substrate such that one of ordinary skill would be motivated to use conveniently known thicknesses which are readily available and already used for TFTs such as those in **Dodabalapur**.

Although the source/drain electrode thickness is not exactly as claimed, it would be an obvious matter of routine optimization to use the instantly claimed range because it has been held that claimed ranges of a result effective variable, which do *not* overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art. See *In re Huang*, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996). In the instant case, **Garnier** is not limited to the exemplary thickness and Applicant has provided no evidence to indicate that there exists anything critical to the thickness range presently indicated. It would have been obvious for one of ordinary skill in the art, at the time of the invention to optimize the thickness of the source/drain electrodes for a particular dimension TFT.

Response to Arguments

9. Applicant's arguments filed 24 March 2003 have been fully considered but they are not persuasive.

On p. 5 of the Amendment filed 24 March 2003, (Paper No. 7), Applicant argues that Garnier does not anticipated the new limitations to the claims 6 and 7, but Applicant's amendments to claims 6 and 7 are anticipated by Garnier as noted above in the rejection. Applicant argues that there is not the third monomeric unit having the B sidechain. This argument is erroneous. As stated above A and A' in Garnier correspond to (I) and (II) in instant claim 6. As restated from above,

> "The sidechains R_1, R_2, R'_1, R'_2, in **Garnier** are equivalent to the instantly claimed sidechains A and B... Since R_1, R_2, R'_1, R'_2, in **Garnier** may be alkyl, they may have less than 4 carbon atoms which anticipates the B sidechain having 1 to 4 carbon atoms. Moreover, since R_1, R_2, R'_1, R'_2, in **Garnier** may be H, Cl, or F, this anticipates the B sidechain having 1 atom."

Regarding claim 16, this argument is moot in view of the amendment leading to the new ground of rejection.

Regarding the features of claim 11, Garnier discloses a plastic substrate at col. 6, lines 21-22. Garnier does not specify the plastic. This has been addressed in the rejection of claim 11 above. However, Garnier does in fact teach the gate dielectric material as noted above. Note that Garnier is not required to use Applicant's claim terminology. As pointed out in the first action on the merits and again above, the "insulating" layer in Ganrier is the "gate dielectric" of the instant claims, as Garnier makes exceedingly clear. For example, the first sentence of the Abstract of Garnier indicates that the device is a thin film transistor of the MIS type. MIS is an acronym for

Metal-Insulator-Semiconductor transistor. Accordingly, the insulator is the gate dielectric. Garnier teaches several of the claimed materials.

On p. 6 of the Amendment filed 24 March 2003, (Paper No. 7), Applicant argues that Garnier in view of Duthaler et al. does not anticipated the features of claims 12-15, 32, and 33. Examiner respectfully disagrees.

Garnier teaches that the substrate may be plastic, as just noted in the previous response to Applicant's argument in this regard. Moreover, as stated in the rejection

> "**Duthaler** teaches a TFT and method of forming said TFT having the substrate, gate and source/drain electrode, and gate dielectric materials of instant claims 12, 15, 32, and 33, as well as the methods for depositing these semiconductor device features in instant claims 13 and 14 (albeit not having patentable weight). (See paragraphs [0034] through [0038], [0061], and [0078].)"

Accordingly, Examiner expressly pointed out where these features were disclosed. Examiner also indicated a suggestion to combine. Applicant is in error indicating that it must come from the text of the applied references. Note that the strongest rationale for combining references is a recognition, expressly or impliedly in the prior art **or drawn from a convincing line of reasoning based on established scientific principles or legal precedent**, that some advantage or expected beneficial result would have been produced by their combination. *In re Sernaker*, 702 F.2d 989, 994-95, 217 USPQ 1, 5-6 (Fed. Cir. 1983).

Further in this regard, the object of the present invention is to provide oligothiophenes to make thin film transistors. There is no evidence of criticality of the materials used to make the ancillary portions of the transistor as the laundry list of materials claimed makes clear.

In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, the suggestion to combine is to make thin film transistors of Garnier with known materials which are in no way critical and are notoriously well known for thin film transistor fabrication, as both Garnier and Duthaler make clear.

10. Applicant's arguments with respect to claims 16-34 on pp. 5-9 of the Amendment filed 24 March 2003 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

This action is made non-final due to the new ground of rejection to claim 11, not necessitated by amendment.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Erik Kielin whose telephone number is 703-306-5980. The examiner can normally be reached on 9:00 - 19:30 on Monday through Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr., can be reached at 703-308-4940. The fax phone numbers for the

organization where this application or proceeding is assigned are 703-872-9318 for regular communications and 703-872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

Erik Kielin
May 18, 2003